U.S. Fish & Wildlife Service

Environmental Assessment

for the

Atlantic White Cedar Salvage and Restoration

at the

Great Dismal Swamp National Wildlife Refuge

DRAFT

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INTRODUCTION

The Great Dismal Swamp National Wildlife Refuge (NWR) is a unit of the U.S. Fish and Wildlife Service (USFWS) national wildlife refuge system, which administers public lands for the protection, conservation, and where appropriate, the restoration of fish, wildlife, and plant resources, and their habitats. The Great Dismal Swamp NWR encompasses over 111,200 acres in southeastern Virginia and northeastern North Carolina (Figure 1). The refuge was established in 1974 for the primary purpose of protecting a vast tract of remnant seasonally flooded forested wetlands, which once covered more than one million acres in the region. Management objectives of the refuge are to restore and maintain its unique ecosystem and to support healthy and diverse flora and fauna that exist or have historically existed in the region (USFWS 2004b).

Atlantic white cedar (AWC) (*Chamaecyparis thyoides*) ecosystems are globally rare communities that occur in a narrow belt along the Atlantic coast from southern Maine to northern Florida and west along the Gulf coast in southern Mississippi. AWC is an economically and ecologically important species that has been declining throughout its natural range over the past 200 years. Less than two percent of the original acreage of AWC is estimated to exist today. Past logging practices including over harvesting and leaving logging debris on site, extensive ditching and draining, conversion of land to farmland and development, and fire exclusion have been the primary causes in the decline of AWC (Atkinson et al. 2000).

Purpose and Need for the Proposed Action

Historically, AWC formed one of the two dominant forest types in the Great Dismal Swamp. Past harvesting practices, changes in hydrologic regime, and fire suppression, however have promoted the establishment of red maple (*Acer rubrum*) dominated communities, and AWC now comprises only about 13,000 acres of the refuge (USFWS 2004b). Although much of the AWC has been lost since the late 18th century, the refuge still contains the only remnant populations of AWC outside of the Eastern Shore in Virginia (Laderman 1989).

In September 2003, Hurricane Isabel inflicted considerable damage to forests throughout the refuge. Some of the worst damage occurred within an estimated 3,000 acres of AWC forests where mature trees were dominant. Storm damage included snapping and uprooting trees, which left the forest floor littered with a thick layer of debris that would prohibit the natural regeneration of cedar. The proposed action is needed to salvage the storm damaged cedar from these areas and promote favorable conditions for the regeneration of these AWC forests. Without salvage and restoration, these damaged forests would likely convert to the maple-gum forest community that now dominates the refuge.

Most of the severely damaged AWC stands are inaccessible to conventional equipment that is used to harvest and transport timber. The proposed action represents the only viable means of reaching much of the damaged areas and creating conditions that are favorable for cedar regeneration.

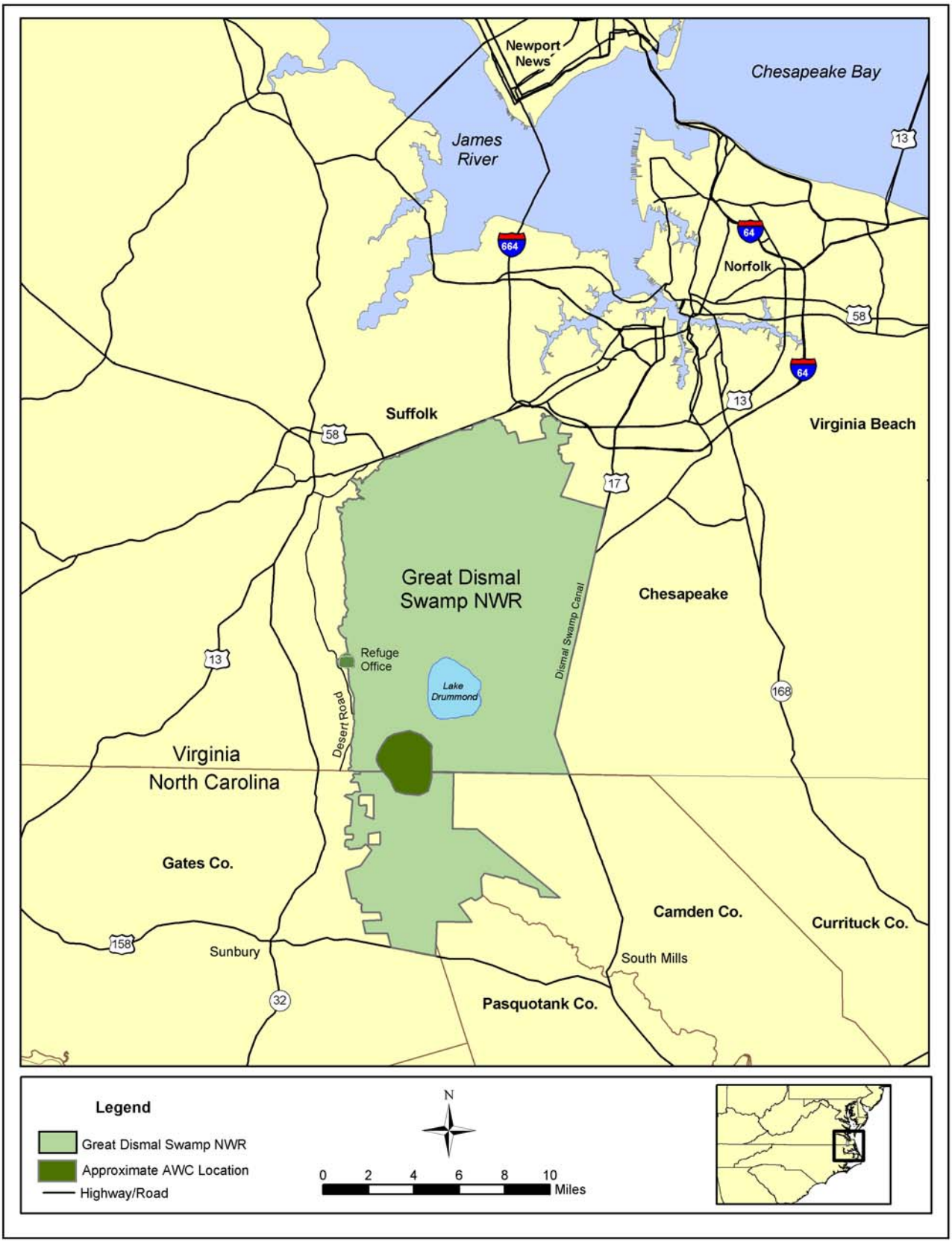

Figure 1. General Location of the Great Dismal Swamp National Wildlife Refuge.

Refuge forest management programs are directed towards restoring and enhancing the natural habitat diversity by restoring natural habitat diversity by restoring or mimicking natural forces that once maintained habitat and wildlife diversity. Management recommendations linked to the establishing legislation of the refuge directed that a "timber management program to include the continuing harvest of select timber species" be one of the primary objectives of the refuge (U.S. Department of the Interior 1974).

Existing Condition

Prior to Hurricane Isabel, the Great Dismal Swamp NWR had approximately 3,600 acres Atlantic white cedar forests where mature (80+ years old) cedars were dominant. The remaining AWC forests consisted of mixed mature cedar and hardwoods or younger (less than 50 years old) cedar-dominant stands. An estimated 85 percent of the mature cedar-dominant stands were destroyed, leaving dead and broken trees with debris covering the forest floor.

Desired Future Condition

The desired future condition of the harvest area is to remove the dead, broken trees; remove tree debris that covers the soil surface; and remove sufficient overstory to permit light to reach the forest floor and promote regeneration of AWC. A minimum of five trees per acre of surviving trees will be retained to provide a seed source. Supplemental planting may be required in those areas where an insufficient number of trees survived the storm.

Regulatory Compliance

This environmental assessment (EA) has been prepared pursuant to Section 102 of the National Environmental Policy Act (NEPA) of 1969, 42 USC § 4231 et seq., which requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process and in accordance with the regulations of the Council on Environmental Quality (CEQ) that implement NEPA procedures. The information presented in this document will serve provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI) would be appropriate.

In order to comply with additional federal and state regulations including the Endangered Species Act (ESA), Clean Water Act (CWA), Clean Air Act (CAA), Coastal Zone Management Act (CZMA), and National Historic Preservation Act (NHPA) reviews and permits could be required prior to project implementation. Potential permits, coordination, and environmental protection plans include, but are not limited to, the following:

- Virginia Erosion and Sediment Control Plan;
- Virginia Water Protection Permit Program;
- Virginia Coastal Resources Management Program; and
- U.S. Army Corps of Engineers (USACE) Wetlands Permit.

Conformance with Applicable Plans

The proposed action is consistent with and supports the Great Dismal Swamp NWR Comprehensive Conservation Plan (CCP) and Environmental Assessment (draft) (USFWS 2004b), the refuge Forest Management Plan of 1987, and the Dismal Swamp Act of 1974 (Public Law 93-402), which identify AWC restoration as a management goal. The proposed use of prescribed fire is also consistent with the refuge's prescribed fire program as described in the 1998 Fire Management Plan (USFWS 1998).

PROPOSED ACTION AND ALTERNATIVES

Alternative 1 – Proposed Action

The USFWS is proposing to harvest blown down and damaged AWC and hardwoods that occur in cedar stands throughout the Great Dismal Swamp NWR. Approximately 3,000 acres would be harvested and managed for AWC regeneration under the proposed action. Included are a 1,500-acre tract that lies between Lake Drummond and Corapeake Ditch in the southeastern portion of the refuge, stands along East Ditch northeast of Lake Drummond, and areas south of Corapeake Ditch that conventional equipment cannot reach.

The proposed harvest would include whole tree harvesting of standing and damaged AWC and hardwood trees followed by various site preparation treatments that would be used to improve natural regeneration of AWC. Because AWC is shade intolerant and requires relatively open conditions for reestablishment, competing species such as red maple and black gum (*Nyssa sylvatica*) would also be removed during the harvest. Harvesting would occur in noncontiguous blocks of varying sizes where blow down and damage were incurred. Where present, good condition, standing AWC trees would be left at a rate of five per acre to serve as seed trees. Supplemental planting may also be used if natural regeneration is not sufficient to establish new stands. Whole tree harvesting would be required to reduce the amount of slash and debris on the site, which increase the risk of wildfire and limit the ability of AWC to regenerate. Future competing vegetation would be controlled through use of a wetland-approved herbicide and potentially, the limited use of prescribed fire. In order to reduce impacts to soils water quality, and residual standing trees, timber removal would be accomplished by helicopter logging. Improved landing sites will be required for loading logs onto trucks and for a helicopter service area. No additional road construction would be required under this alternative, though road improvement (geotextiles and gravel) would be required on approximately five miles of road. Harvested timber would be transported from the project site via internal refuge roads to external roads including Desert Road, State Highway 32, and U.S Highway 158.

Project Design Specifications Common

Harvest Operations. The proposed action includes the removal of approximately 3,000 acres of blown down and storm-damaged timber, which consist primarily of AWC with lesser amounts of hardwood including red maple, sweetgum (*Liquidambar styraciflua*), and black gum. Tree felling operations would be conducted by on-the-ground crews of 10 to 20 cutters and by mechanized harvesting. Mechanized harvesting would utilize specialized equipment and

techniques for harvesting in wetlands such as low-ground-pressure wide-tracked feller-bunchers with a minimum of three-foot wide tracks and boom-mounted swing feller-bunchers. Slash and small, non-merchantable timber would also be laid as a corduroy road in front of heavy equipment to further reduce rutting and soil compaction.

Yarding Operations. Yarding operations would be conducted by helicopter. The helicopter model that would be used in not known, therefore a range of operational specifications will be described in the impacts analysis included in this EA. Analyses will be based on minimum and maximum helicopters, as expressed in payload size that would be expected to be used in logging operations and would range from 6,000 lbs. (i.e. Kaman K-MAX) to 22,000 lbs. (i.e. Sikorsky Skycrane or Boeing Chinook 234). Using aboveground biomass estimates for mature AWC (60 to 70 years) of 80 tons per acre (DeBerry et al. 2000) and a rate of 20 turns per hour, tree removal from 3,000 acres would range from 136 days (Skycrane) to 500 days (K-MAX), depending on the helicopter used.

Landings/Service Areas. Log landings, support areas, staging areas, and helicopter service landings required for the timber harvesting operation would be constructed on existing roads at locations that would limit helicopter turns to approximately one mile to reduce travel time and operational costs. Helicopter service landing size requirements vary with helicopter size and would range from 120 by 160 feet to 250 by 250 feet, excluding support equipment and fuel storage. The landing sites would be underlain by corduroy logs and surfaced with rock, if necessary, in such a manner that would support helicopters, log handling equipment, and service or support equipment. At the completion of the operation, all landings and service areas would be graded to permit water to drain or spread and any temporary fill would be removed. In addition, all landings and service areas would be ripped and seeded with a native grass and forb seed mix to reduce compaction and runoff after logging.

Road Improvements. Depending on the quantity of wood harvested, between 10 and 30 trucks (based on a 60,000 lb. trailer capacity), would be required to transport the timber per day. The timber would be transported via interior refuge roads and Desert Road along the western border of the refuge to state highways. Approximately 5 miles of interior refuge road would be improved to be able to support a high volume of logging trucks during this action. Improvement would include grading the roads, applying a layer of geotextile fabric, and gravel. Approximately five miles were graded and improved under a previous action.

Silvicultural Treatments. Because whole tree harvesting would be conducted, little additional site preparation would be required for seedbed preparation. A somewhat rutted and irregular substrate provides a range of microsites that benefit seedling germination. Mechanical treatments such as drum chopping or bush hogging, however could be used prior to planting if competing vegetation has become established on the site. Prescribed burning may also be implemented on a small scale to expose more decomposed organic soil and control competing vegetation.

Natural regeneration from seed trees (five residual per acre and adjacent unharvested stands) and the existing seedbank would be relied upon to the greatest extent possible. However, direct seeding or supplemental planting of nursery stock would be used if natural regeneration is insufficient (e.g., <60 percent stocking), to stock the site.

Once AWC seedlings are established, herbicides would be used to control competing vegetation if seedling survival is at risk. Because of the extent of the area likely to require treatment, aerial spraying (via helicopter) would be used herbicide applications. Label instructions and application rates would be strictly adhered to. Arsenal is currently the primary herbicide used in cedar regeneration because it is approved for wetlands and is known to be affective in controlling red maple. It is not approved for use in areas with standing water; therefore ditched areas would be avoided.

Water Control. In-place water control structures would be used to draw down water levels prior to harvesting to facilitate site access. Water levels would be returned to normal levels as soon as possible following harvest operations to ensure adequate moisture is available for AWC seed germination and that oxidation of the peat substrate is minimized. If prescribed burning were used for site preparation, water levels would be adjusted to ensure soil moisture is high enough to prevent peat ignition, which would be detrimental to cedar regeneration.

Alternative 2 – No Action

Under the no action alternative, no salvage or harvesting of blown down and storm-damaged AWC at the Great Dismal Swamp NWR would occur. Seedbed preparation and supplemental planting would also not occur. Prescribed burning in a portion of the area would continue to be used to maintain the existing pond pine *(Pinus serotina*) communities and for fuels management as described in the draft CCP (USFWS 2004b). Burning during drought conditions would be avoided to prevent ground fires that could burn into the peat and destroy living pines. Water levels could also be manipulated to reduce the risk of destructive ground fires.

Alternatives Eliminated from Consideration

Mechanical harvesting and the use of ground-based skidders or forwarders was considered as an alternative to helicopter logging as a method of salvaging the blown down and storm-damaged AWC at the Great Dismal Swamp NWR. A large percentage of the damaged AWC, however, occurs on extremely wet soils and is located two or more miles from potential landing sites. Because many of these stands are virtually inaccessible to ground-based equipment, this alternative was eliminated from consideration.

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND NO ACTION ALTERNATIVE

This chapter describes relevant existing environmental conditions for resources potentially affected by the proposed action. In compliance with guidelines contained in NEPA and CEQ regulations, the description of the affected environment focuses on those environmental resources potentially subject to impacts. Therefore, the following resources areas are analyzed: soils; water quality; vegetation; wildlife; rare, threatened, and endangered species; recreation; air quality; socioeconomics and environmental justice; and noise. The following resource areas have been eliminated from further analysis:

Airspace. Impacts to airspace use by civil, commercial, and military users are not expected to occur, principally because the proposed action does not entail flight at altitudes that should affect

other users. It is anticipated that helicopter traffic associated with this action would not exceed 500 feet above ground level. The project site is located southeast of Lake Drummond in Class G, uncontrolled airspace and most associated flight activity would be confined to this area.

Safety and Health. Impacts to safety and health are not expected based on existing guidelines for harvesting and prescribed burning procedures. The harvest process would be conducted by trained contractors. Each contractor would conform to the Occupational Safety and Health Administration's (OSHA) logging safety standards as prescribed in 29 Code of Federal Regulations (CFR) Part 1910.266, equipment lock-out/tag-out standards in 29 CFR Part 1910.147, and hazardous communication standards in 29 CFR Part 1910.1200. In addition, specific contractual guidelines are established for helicopter yarding operations, sanitation, and fire control.

All prescribed fires would be conducted in accordance with safety precautions outlined in the refuge fire management plan (USFWS 1998) and all personnel involved in prescribed burns would be appropriately qualified.

Land Use. The proposed harvest and reestablishment of approximately 3,000 acres of AWC habitat at the Dismal Swamp NWR is consistent with refuge management objectives and would not change the existing land use within the refuge or in the surrounding community.

Hazardous Materials and Waste Management. Potential hazardous materials to be used and stored on site would include oil and gas. A spill control and countermeasures plan would be developed if storage of oil exceeds 1,320 gallons or if a single container exceeds a capacity of 660 gallons. All gas would be stored in approved steel containers with self-closing lids.

Socioeconomics and Environmental Justice. The proposed action would generate additional spending during the period of harvesting operations and timber processing only, some of which would flow into the regional economy. No new employment opportunities would be generated from the proposed action; therefore, there would not be any change in the employment and personal income profile of the region. Since there would be no social or economic impacts associated with this alternative there would be no impacts to minority or low-income populations within the region of influence. Therefore, selecting this alternative would not result in environmental justice impacts.

Soil Resources

Soils at the Great Dismal Swamp NWR are classified as organic or mineral. Organic soils (soils with greater than 16 inches of organic matter) are the dominant soil types. These soils are generally a black, fine-grained, highly decomposed mucky peat and are characterized by poor or very poor drainage, and high acidity. The organic soils are highly susceptible to fire and the underlying mineral soils may be exposed in areas that have experienced severe wildfire or periodic prescribed burns. Organic soils in the refuge have also been depleted by excessive draining, which results in increased oxidation of organic matter.

Mineral soils (soils with less than 16 inches of organic matter) are less common and are generally limited to the higher elevations in the western portion of the refuge and historic

outflows of tributaries to the Elizabeth, Northwest, and Pasquotank Rivers. Mineral soils also occur on sites that have experienced severe wildfires or periodic prescribed fires, which have consumed the organic soil layers.

The AWC communities at the refuge are generally restricted to sites with organic soils, though cedar is capable of becoming established on mineral soils as well (Mylacraine and Zimmerman 2000).

Impact of Proposed Action

Soil compaction and disturbance caused by mechanical harvesting activities would be the primary sources of direct effects to the soil. Compaction and disturbance impacts would be minimized during harvest operations by using specialized low pressure machinery equipped with wide tracks. Using helicopters to remove trees from the swamp would minimize off-road vehicular movement and eliminate ground skidding and other harvesting activities that could impact soils.

Temporary compaction and disturbance would occur on log landings and the helicopter service landing, but would be mitigated by erosion control measures, grading, ripping, and seeding, which would occur as soon as possible after soils have been disturbed. Log landings and staging areas would be located on existing roads and would therefore not impact soil resources.

Additional impacts to the soils would be caused by lowering the water level in the swamp for the duration of logging activities. The oxidation of organic materials and loss of peat soils would occur during this time. The use of helicopters for timber removal would reduce the harvesting operations to 136 to 500 days, compared to the multiple-year operation that would be required by traditional ground-based logging methods.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. No change to the current soil conditions at the Great Dismal Swamp NWR would take place.

Water Resources

The Great Dismal Swamp NWR lies within the Roanoke-Tar-Neuse-Cape Fear and the Chesapeake Bay-Susquehanna River watersheds. The refuge is the largest remnant of once extensive seasonally flooded wetlands. In the center of the refuge is Lake Drummond, a 3,108 acre lake with maximum depths of approximately seven feet. Groundwater flows into the refuge from the west through the shallow Norfolk aquifer and is discharged by seeping directly into Lake Drummond. Surface water input into the swamp occurs by precipitation as well as stream and sheet flow from about 82 square miles along the Suffolk Scarp, west of the refuge. Most outflow of water occurs during winter and spring (USFWS 2004b).

The surface and ground waters of the Great Dismal Swamp NWR have been altered over the last 200 years by a 150 mile network of ditches and canals with 30 water control structures. The extensive network of ditches and canals has disrupted natural water flow patterns. Most surface

water now drains from the refuge through this network. Many of the refuge's ditches channel surface water into Lake Drummond, which drains into the Feeder Ditch and then into the Dismal Swamp Canal, a link in the Atlantic Intracoastal Waterway system, which lies along the eastern boundary of the refuge. Water depths in the canal are maintained by the USACE. Lake Drummond is the primary source of water for maintaining waters of navigable depth in the Dismal Swamp Canal. Other ditches including Corapeake, Big Entry, and several smaller ditches, drain directly into the Dismal Swamp Canal. Several ditches in the southern portion of the swamp drain into Cross Canal and ultimately into the Pasquotank River basin. Jericho Ditch drains northwest to Shingle Creek and also south to Lake Drummond (USFWS 2004b).

Historically, the hydrologic cycle of the Great Dismal Swamp resulted in seasonal changes in water levels. Fall was the driest season with little or no standing water, outside Lake Drummond and large stream channels, and a low water table. In the winter, rains and slowed evapotranspiration rates caused by low temperatures caused the water table to rise until it reached the ground surface and streams to flood and flow over the ground surface. By spring, floods in the swamp would reach their peak and little lateral movement of water occurred (USFWS 2004b).

Impact of Proposed Action

The proposed action includes the harvest or salvage of approximately 3,000 acres of AWC timber that was largely blown down or damaged by Hurricane Isabel in 2003. The reduction in evapotranspiration from the proposed tree harvest would have minimal further impact to the refuge's hydrologic regime than that already caused by the loss of the existing forest cover from the hurricane.

The proposed tree harvesting operations are expected to result in temporary minor increases in runoff into adjacent canals. To minimize impacts to water resources, trees would be felled by on-ground crews or mechanized harvesters designed for use in wetlands. Helicopters would be used to remove felled trees to a central loading area, minimizing disturbance to ground surface and subsequent erosion and runoff of sediments into the waterways of the refuge. Use of best management practices as outlined in *Forestry Best Management Practices (BMPs) for Water Quality in Virginia* (Virginia Department of Forestry 2002) during and after harvesting activities would further reduce impacts to surface waters.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. No change to the current water quality or water management regime at the Great Dismal Swamp NWR would take place.

Wetlands

Other than the existing roadways, sites that have been filled for construction, and approximately 600 to 900 acres of upland forest (the mesic mixed hardwood forest), the entire Great Dismal Swamp NWR is a matrix of forested and emergent wetlands and open water habitats.

Impact of Proposed Action

As with water quality, the proposed action is expected to have minor, temporary increases in runoff and sedimentation to waterways. Timber harvesting is a normal silvicultural practice that is exempt under Section 404 of the CWA providing state-approved voluntary and federally mandated BMPs are implemented. All wetland protection practices would be implemented during harvest and site restoration operations.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. No change to the current wetlands at the Great Dismal Swamp NWR would take place.

Vegetation

Existing vegetative communities at the Great Dismal Swamp NWR include six major forest types. The most dominant community type, the maple-gum swamp, encompasses over 60 percent of the refuge. This community type commonly inhabits sites previously dominated by cypress-gum (*Taxodium distichum-Nyssa aquatica*) or AWC (Laderman 1989). Past harvesting practices, alterations in hydrology, and suppression of wildfire, however have favored the development of maple–gum swamps over other community types. Red maple is the dominant tree species in this community type, with lesser amounts of black gum and periodic black cherry (*Prunus serotina*) also occurring. Cypress-gum was formerly the most extensive community at the refuge, but is now largely restricted to areas in the western portion of the refuge, where ground water levels are highest. Bald cypress and black gum are the dominant species in this community. The cypress-gum association currently comprises 12 percent of the refuge area. Relatively pure stands of AWC are also becoming rare and account for approximately three percent of the refuge. More than 8,000 acres of AWC also occur in mixed stands of cedar and hardwood or pond pine. Stands of mature AWC were particularly hard hit during Hurricane Isabelle in 2003, and up to 3,000 acres are estimated to have been damaged. Non-riverine pine-hardwood forests and pond pine pocosins comprise another 12 percent of the forested area at the refuge. Pure pond pine occurs in fire-maintained communities that are created by catastrophic fire events and require periodic fire for maintenance. This community type is being replaced by mixed pond pine-hardwood stands because of fire exclusion at the refuge. Mesic hardwoods are stands of mixed deciduous tree species occurring at the higher elevations and better-drained mineral soils of the refuge. The mesic mixed hardwood community is less than one percent of the refuge (USFWS 2004b).

The shrub layer throughout the refuge varies in density between community types. Common species include bitter gallberry (*Ilex coriacea*), inkberry (*Ilex glabra*), fetterbush (*Lyonia lucida*), downy leucothoe (*Leucothoe axillaris*), titi (*Cyrilla racemiflora*), myrtle (*Morella cerifera*), redbay (*Persea borbonia*), and sweet pepperbush (*Clethra alnifolia*). Along ditch edges and other disturbed sites, thick tangles of blackberry (*Rubus* spp.), catbrier (*Smilax* spp.), and muscadine grape (*Vitis rotundifolia*) frequently occur. Poison ivy (*Toxicodendron radicans*) forms a nearly continuous ground cover and even shrub layer over portions of the forest. The herbaceous layer is generally sparse though some areas have patches of ferns, grasses, and

sedges. Dense patches of switch cane (*Arundinaria gigantea*), which previously formed extensive canebrakes throughout the area are now uncommon in the refuge.

The proposed project area consists of stands of blown down AWC, storm-damaged but standing AWC, and areas of cedar mixed with red maple and other hardwoods.

Impact of Proposed Action

The proposed action includes managing approximately 3,000 acres of the AWC forest in the Great Dismal Swamp NWR. Proposed activities include the removal of hurricane damaged and fallen cedars, followed by the reestablishment of AWC through site preparation, planting, and controlling competing vegetation as necessary.

Implementation of the proposed action would result in a temporary reduction in forest cover beyond the current condition by removing much of the residual standing AWC and hardwood component of the project area to facilitate AWC regeneration. The long-term affect would be an increase in the extent of AWC community and greater species diversity at the refuge.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. In the short-term the risk of wildfire would be greatly increased because of the large quantity of timber and debris that currently exists on the forest floor. The long-term affects of the no action alternative would be the encroachment of red maple into the project area and the conversion of 3,000 acres of AWC to a maple-gum swamp.

Wildlife

Various wildlife surveys and inventories at the Great Dismal Swamp NWR have documented at least 209 avian species (92 breeding birds, and 49 year-round residents), 62 species of herptiles, 27 fish species, 47 mammals, and several hundred species of insects. Important wildlife of the refuge that are habitat generalist include black bear (*Ursus americanus*) and white-tailed deer (*Odocoileus virginianus*). The Great Dismal Swamp contains one of the northernmost coastal breeding populations of black bears in eastern Virginia and extreme northeastern North Carolina. A bear population study in 1988 estimated the refuge contained 200-300 bears, though recent bear harvest data and other indicators suggest the bear population is growing.

The population of white-tailed deer increased in the first half of the century when logging created additional habitat. The white-tailed dear population at the refuge is considered at or above habitat carrying capacity (Virginia Department of Game and Inland Fisheries [VDGIF] 2002) because of the decline in available habitat. Since little timbering has occurred since 1976, the openings that deer depend on for food are becoming reforested and reducing the quality of deer habitat. Forest management plots, prescribed burning, and road maintenance (clearing and mowing) have helped mitigate for these impacts. To maintain the appropriate relationship between the deer herd and its habitat, the deer are hunted annually (USFWS 2004b).

The AWC community provides important habitat for many of the wildlife species occurring at the refuge. This habitat is preferred by several species (specialist) but in general, most species utilize multiple (generalist) habitat types. A number of neotropical migratory birds, in particular, have been found to be closely associated with AWC community. Included are: black-throated green warbler (*Dendroica virens*), Swainson's warbler (*Limnothlypis swainsonii*), worm-eating warbler (*Helmitheros vermivora*), prairie warbler (*Dendroica discolor*), and prothonotary warbler (*Protonotaria citrea*). These three bird species are found in other habitats but may maintain denser population in AWC forest of the coastal plain (Terwilliger 1987). The larva of the butterfly species, Hessel's hairstreak (*Mitoura hesselli*) also feeds exclusively on AWC (Cryan 1985) and is therefore reliant on this habitat type to maintain a viable population.

Impact of Proposed Action

The damage associated with Hurricane Isabel has already impacted the AWC community and its associated wildlife as the current forest density is a remnant of its pre-storm condition. This natural event has changed the habitat in several ways including increased snags, downed wood, and light penetration. These disturbed conditions will allow competitive plant species to begin successional changes to the habitat. The impacts to wildlife include loss of habitat and long and short-term displacement of individuals and species. Species such as the black-throated green warbler and Hessel's hairstreak have experienced the most significant loss of habitat.

With a few minor, temporary exceptions, the proposed action would not negatively impact the wildlife of the AWC forest beyond its current level. Forest harvesting activities would impact individual wildlife species by short-term displacement. However, the project area is from 2 to 2 1/2 percent of the refuge and sufficient habitat exists outside of the project area to which individual could relocate. Short-term positive effects include increased successional habitat that would benefit species such as white-tailed deer, black bear, and a variety of bird species. Long-term positive effects include the restoration of AWC habitat required for each of the specialist species mentioned above.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. Loss of habitat diversity resulting from no action would have long-term affects on species such as the black-throated green warbler, and Hessel's hairstreak and other specialist species that utilized the AWC community.

Rare, Threatened, and Endangered Species

Three federally listed species are known occur or are known to have occurred in the past at the Great Dismal Swamp NWR. Included are the endangered red-cockaded woodpecker (*Picoides borealis*), the endangered red wolf (*Canis rufus*), and the threatened bald eagle (*Haliaeetus leucocephalus*). One additional federal species of concern, Duke's skipper (*Euphyes dukesi*), a butterfly, has also been observed at the refuge (USFWS 2004b, VGIF 2003).

The red-cockaded woodpecker was observed on the refuge until 1974, but has not been known to nest in the area since 1961 (USFWS 2004b). This species requires a habitat of mature pine

forest. Currently, reintroduction plans of the red-cockaded woodpecker are being considered by the USFWS at the refuge. This proposed effort would exclude AWC forest from the proposed reintroduction sites.

The Great Dismal Swamp is within the historic range of the federally endangered red wolf. No red wolves are currently known to inhabit the refuge; however, in 1996 one red wolf was trapped and returned to Alligator NWR in North Carolina (USFWS 2004b). Any habitat of sufficient size that offers adequate food, water and vegetative cover is adequate for this species. The current habitat size deemed appropriate for this species by the USFWS is approximately 144,000 acres. The Great Dismal Swamp NWR is approximately 111,200 acres in size.

The bald eagle has one active nest site on the refuge, identified in 1997, that is located on Lake Drummond (Watts and Byrd 2003). Wintering bald eagles are also seen on the refuge with peak populations of 15 to 20. Guidelines for bald eagle protection on the refuge have been developed by the Virginia Department of Game and Inland Fisheries (VDGIF) and the USFWS, Virginia Field Office. Activities proposed within 1,320 feet of the nest site are reviewed by VDGIF and USFWS.

Duke's skipper is a known resident of the Great Dismal Swamp NWR. Its known preferred habitat is generally cypress-gum swamps. Its larval forage plant is several sedge species where as the adults feed on pickerel weed (*Pontederia cordata*), blue mistflower (*Eupatorium coelestinum*), and several other emergent wetland species.

Three state-protected wildlife species (USFWS 2004b, VGIF 2003) have been documented within the Great Dismal Swamp NWR. Included are the endangered canebrake rattlesnake (*Croatalus horridus atricaudatus*), the endangered eastern big-eared bat (*Plecotus rafinesquii macrotis*), and the threatened Dismal Swamp southeastern shrew (*Sorex longirostris fisheri*). Additionally, nine state wildlife species of concern have been observed within the refuge, red-breasted nuthatch (*Sitta canadensis*), golden-crowned kinglet (*Regulus satrapa*), Swainson's warbler (*Limnothlypis swainsonii*), brown creeper (*Certhia americana*), magnolia warbler (*Dendroica magnolia*), oak toad (*Bufo quercicus*), carpenter frog (*Rana virgatipes*), marsh rabbit (*Sylvilagus palustris palustris*), and northern river otter (*Lontra canadensis lataxina*) (USFWS 2003, VGIF 2003).

Rare plant species occurring at the refuge include Virginia dwarf trillium (*Trillium pusillum* var. *virginianum*), a federal species of concern, which occurs in pine-hardwood forests. Sheep laurel (*Kalmia augustifolia*), and purple bladderwort (*Utricularia purpurea*), two state species of concern, and silky camellia (*Stewartia malacodendron*), a state watch list species (Townsend 2003), have been observed at the refuge.

Of the above rare, threatened, or endangered species, the most likely residents of the AWC communities include the canebrake rattlesnake, eastern big-eared bat, Dismal Swamp southeastern shrew, red-breasted nuthatch, golden-crowned kinglet, and Swainson's warbler. The remaining species are not likely to utilize the AWC forest due to habitat requirements.

Impact of Proposed Action

The proposed action would not include habitat utilized by nesting or over wintering bald eagles or the proposed habitat for the reintroduction of red-cockaded woodpecker. The proposed action is therefore not expected to impact any federally protected species known to occur or proposed for reintroduction on the refuge. Habitat utilized by the federal species of concern, Duke's skipper, would also not be affected by the proposed action. Therefore this species is also not expected to be impacted.

The above-mentioned species that are most likely to utilize the AWC community would enjoy short- and long-term benefits from the reestablishment of this habitat type. Short-term positive effects would include increased early successional habitat, which would benefit species such as canebrake rattlesnake, Dismal Swamp southeastern shrew, oak toad, Swainson's warbler and marsh rabbit. The reestablishment of AWC habitat would provide long-term benefits to the eastern big-eared bat, red-breasted nuthatch, and golden-crowned kinglet.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. The resulting succession of the area to maple-gum swamp community would not provide the benefits as described above for AWC communities.

Cultural Resources

Human occupation of the Great Dismal Swamp area dates back to the Paleo-Indian period (12,000 to 8,000 B.C.) when the swamp was dominated by oak-hickory forest. Evidence of Paleo-Indian occupation has been identified at locations north and west of the refuge (Whitehead and Oakes 1979). By the time European colonists arrived, the area had acquired is swamp-like characteristic and most Native Americans lived in peripheral settlements. Cultural artifacts found within the refuge and along its edges provide evidence that the area was used as hunting and fishing grounds. Corn pollen found in pollen samples taken from near Lake Drummond indicate the swamp was used for farming. A cultural resources reconnaissance was conducted in the Great Dismal Swamp in the fall of 1978, it was noted that prehistoric sites are more likely to occur on well-drained land within the swamp rather than the inundated swamp areas (USFWS 2004b).

The refuge is a designated site on the National Park Service's Underground Railroad Network to Freedom. The Great Dismal Swamp served as a hiding place for African-Americans escaping slavery in the 18th and 19th centuries. Historians believed these people established communities within the swamp. Limited archeological research has been completed to determine the location and existence of the communities (USFWS 2004b). In addition, the Dismal Swamp Canal on the refuge's eastern border is the oldest continually operating man-made canal in the United States and is included in the National Register of Historic Places and is designated as a National Civil Engineering Landmark (USACE 2004).

Impact of Proposed Action

Though no known cultural resources exist within the project area, timber harvesting has the potential to unearth unknown cultural resources. Based on the history of the limited use of the Dismal Swamp by humans, it is unlikely that cultural resources would be located during project implementation. If an artifact were found, work in the immediate area would cease, and consultation with the State Historic Preservation Officer (SHPO) would occur. Continued timber harvesting in the area would be conducted in accordance with guidelines from SHPO.

Impact of No Action

Under the no action alternative, the proposed timber harvest and subsequent management activities would not occur. No change to the current cultural resources in the Great Dismal Swamp NWR would occur.

Air Quality

The U.S. Environmental Protection Agency (EPA) has designated National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter equal to or less than 10 microns in diameter, ozone, and lead. The NAAQS represent the maximum levels of pollutants that are considered safe, with an adequate margin of safety to protect public health and welfare. The EPA designates all areas of the U.S. as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. The Great Dismal Swamp NWR is located within the cities of Chesapeake and Suffolk in Virginia and in Gates, Pasquotank, and Camden counties in North Carolina. On February 5, 1997, EPA approved the re-designation of Suffolk and Chesapeake to an attainment area for ozone (EPA 2004). With the re-designation, these cities are considered a maintenance area for 10 years. Suffolk and Chesapeake are in attainment of all other criteria pollutants. Gates, Pasquotank, and Camden counties are in attainment for all criteria pollutants (NC Department of Environment and Natural Resources 2004).

The primary mechanism to achieve and maintain NAAQS is the EPA-required State Implementation Plan (SIP). The SIP identifies goals, strategies, schedules, and enforcement actions that will lead each state into compliance with NAAQS. The Clean Air Act requires federal agencies to demonstrate conformity with the SIP for attainment of the NAAQS. To demonstrate conformity, project emissions must be less than a minimum threshold level (the *de minimis* level) established in 40 CFR 93.153 or must be consistent with the SIP. The refuge's 1998 Fire Management Plan includes the use of prescribed fire for site preparation and forest regeneration as a management activity. An EA for the prescribed fire program at the refuge was submitted to the Virginia Department of Environmental Equality and the Virginia and North Carolina State Foresters for review. The EA resulted in a FONSI. The prescribed burning proposed in this EA is part of that described in the 1998 Fire Management Plan; therefore a conformity determination is not required.

Impact of Proposed Action

Potential air quality impacts under the proposed action would result from heavy equipment and helicopter emissions and the potential limited use of prescribed burns. Localized, minor, short-term impacts would result from heavy equipment emissions during harvesting and mechanical clearing. Approximately 10 to 30 heavy duty diesel trucks would be used to transport timber to local a saw mill material for a period of up to 500 days (based on a maximum 3,000-acre harvest). One helicopter would be used during logging operations for duration of up to 500 days. Based on these estimates, annual emissions would be negligible and would not exceed *de minimus* levels or violate standards of the Virginia or North Carolina SIP.

Impact of No Action

Air quality impacts would be associated solely with wildland fire since no treatments would be completed. Under current conditions, fires would likely be large, intense, and fast spreading, making control difficult. Since heavy, continuous fuels yield the most air pollutant emissions during combustion; severe air quality impacts would be likely until the fire was extinguished.

Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, or is otherwise annoying. Human response to noise varies according to the type and characteristics of the noise source, distance between source and receiver, receiver sensitivity, and time of day. The Great Dismal Swamp NWR is publicly used for wildlife viewing, hiking, and other recreational activities. Loud noise is uncommon and most patrons visit the refuge to enjoy the quiet, serene environment. Within the surrounding residential areas, typical sound levels may be expected to range from 50 to 60 decibels (dBA) (Kinsler et al. 1982).

Impact of Proposed Action

Temporary minor impacts from noise would result from chainsaw and equipment use, heavy truck traffic, and helicopter traffic during logging operations. These noise sources range from 80dBA to 110dBA and are typically found to be annoying by the public. The logging operations would occur several miles from the refuge's primary public access points (Washington and Jericho ditches) and at least two miles from any private residence and would therefore not be expected to significantly impact the public. The greatest noise impacts associated with the proposed action would result from heavy truck traffic. Up to 30 logging trucks per day, during daylight hours, would travel Desert Road to state route 32. The maximum noise level for the trucks traveling along these roadways is expected to be 87 dBA (Cowen 1994, FHWA 2000). At a distance of 426 feet (130 meters) from the roadway, truck noise is expected to attenuate to ambient levels (approximately 60 dBA). Trees, buildings, and atmospheric elements such as wind and air temperature would most likely increase attenuation resulting in a reduction of the noise propagation range. The increase of 27 to 37 dBA above ambient noise levels up to 30 times a day represents a temporary, significant potential impact to residences occurring along the proposed transport route.

Impact of No Action

No impacts from noise would occur without the prescribed treatments. Existing quiet conditions would continue.

Cumulative Impacts

The USFWS has plans to conduct additional timber harvesting in a portion of the Great Dismal Swamp NWR east of the proposed AWC harvest area. This action would include the selective removal of hardwoods (primarily red maple) on up to 1,600 acres in an area previously dominated by pond pine. The project is intended to enhance the pond pine habitat on the refuge prior to the reintroduction of red-cockaded woodpecker (*Picoides borealis*). A separate, smaller scale harvest of AWC encompassing approximately 100 acres that also suffered extensive damage by Hurricane Isabel will have been completed before these operations begin. The cumulative time period for the proposed actions would depend on the size helicopter employed and would range from 186 to 677 days. The cumulative impact of these actions is expected to be similar to the impacts described for the action proposed in this EA. It is expected that temporary and localized impacts to noise and air quality would occur in association with each of these actions. If the actions are implemented at different times, there would be no cumulative impact expected for these resources. Positive long-term impacts to vegetation and wildlife are expected to result from each of these actions. Soil and water resources are expected to experience temporary negative impacts from the actions. The use of BMPs would reduce these impacts.

CONSULTATION AND COORDINATION

Agencies and organizations consulted during preparation of this EA or provided with copies for review include: The Nature Conservancy Green Sea Program, Chesapeake VA; VA Department of Game and Inland Fisheries; VA Department of Conservation and Recreation Division of Natural Heritage; Virginia Department of Forestry, NC Dismal Swamp State Natural Area; NC Division of Parks and Recreation; NC Forest Service; NC Wildlife Resources Commission; USFWS Ecological Services, Virginia Field Office; US Army Corps of Engineers, Norfolk District; Great Dismal Swamp Coalition; City of Suffolk; City of Chesapeake; Dr. Robert Atkinson, Christopher Newport University; Dr. Lytton Musselman, Old Dominion University; and several adjacent private landowners.

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